Maths Parent Workshop

14th November 2023

- What is ‘mastery’?
- What do small steps in mastery look like?
- How does our mixed-age curriculum work in maths?
- How are children challenged?
- How can I help at home?
- Feedback

What is 'Mastery'?

Mastery assumes that…

All pupils can succeed.

What is 'Mastery'?

Whole-class teaching

All pupils can achieve

Sequencing

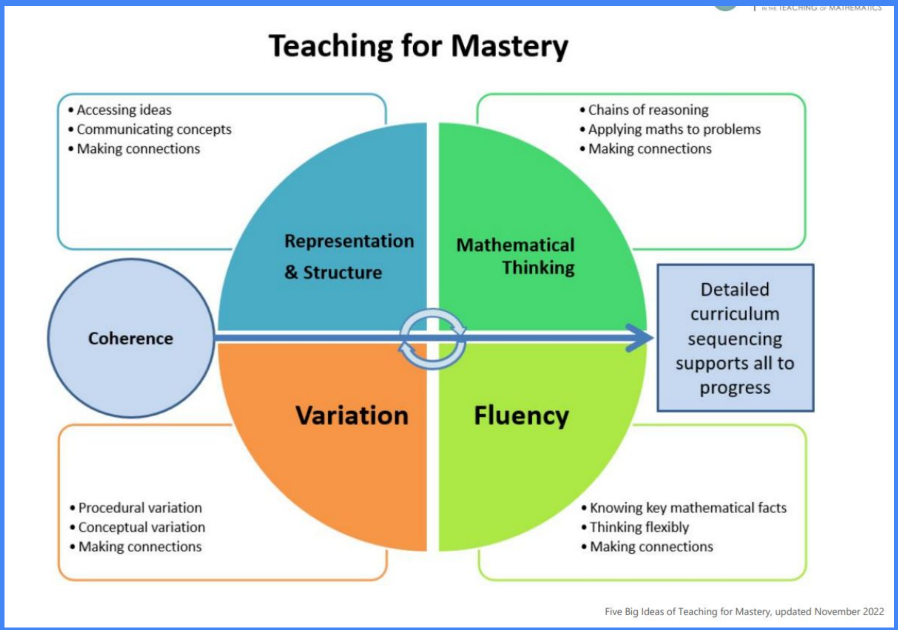
Design links to prior learning to ensure all can access the new learning and identifies ***carefully sequenced steps*** in progression to build secure understanding.

NCETM
NATIONAL CENTRE FOR EXCELLENCE IN THE TEACHING OF MATHEMATICS

- Examples, representations and models are carefully selected to expose the structure of mathematical concepts and **emphasise connections**, enabling pupils to **develop a deep knowledge of mathematics.**

- Key number facts are learnt to **automaticity,** and other key mathematical facts are learned deeply and practised regularly, to avoid cognitive overload in working memory and enable pupils to focus on new learning.

These are the 5 big ideas in Teaching for Mastery.



For more information on 'Teaching for Mastery' and the 5 big ideas, visit the NCETM website .

Tips and Tricks are counter-productive

> Curriculum planning around the teaching of mathematical facts and methods is usually strong. Where it is weaker, however, it tends to take less account of what pupils have learned previously and what they will study later. In these schools, pupils often are taught a series of disconnected mathematical methods and 'tricks' that apply only in specific circumstances.

Mastery is a move away from tips and tricks, towards a deep understanding of maths and ***why*** the tricks work.

$$\frac{2}{5} of\, 45 =$$

"Divide by the bottom, times by the top"

$$394 \times 10 =$$

"Just add a zero"

$$\frac{3}{10} \div \frac{2}{4} =$$

"KFC - Keep, Flip, Change"

Phase 2

Fraction Outcome

- 3F-1 Interpret and write proper fractions to represent 1 or several parts of a whole that is divided into equal parts.
- 3F-2 Find unit fractions of quantities using known division facts
- 3F-4 Add and subtract fractions with the same denominator, within 1.
- 4F-1 Reason about the location of mixed numbers in the linear number system.
- 4F-2 Convert mixed numbers to improper fractions and vice versa.
- 4F-3 Add and subtract improper and mixed fractions with the same denominator, including bridging whole numbers.

6 learning outcomes

21 learning outcomes

20 learning outcomes

20 learning outcomes

At the end of Phase 2, children will be expected to answer a question like this.

- *'The table below shows how many hours Josie read each day for a week. How long in total did she spend reading during the week?'*

Mon	Tues	Wed	Thurs	Fri
$1\frac{3}{4}$ hours	1 hour	$1\frac{1}{4}$ hours	$1\frac{1}{4}$ hours	$2\frac{3}{4}$ hours

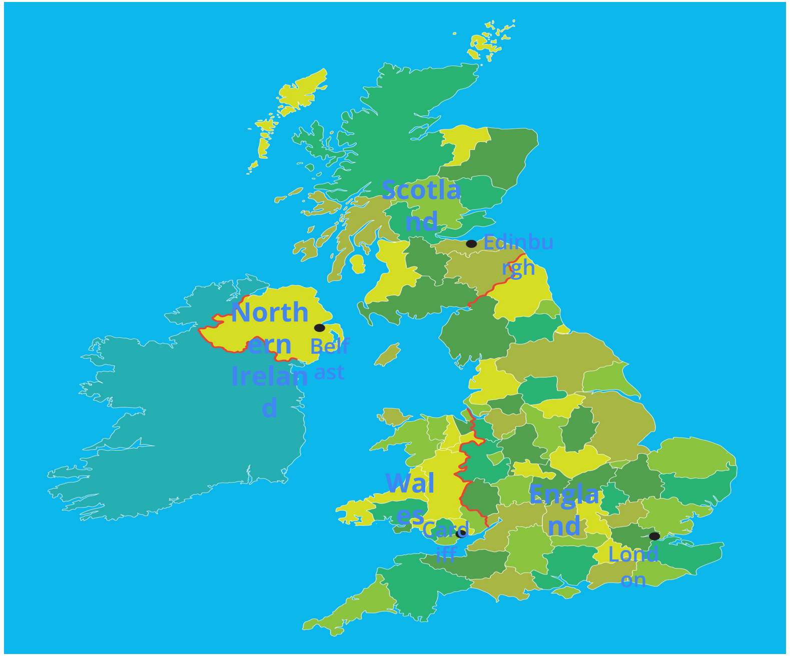
For children to fully understand this, they must understand all the objectives on the left. In mastery, this is a journey for ***67 carefully sequenced small steps***.

What do small steps in mastery look like?

- The following 50 slides show a sequence of learning that aim to develop children's understanding of fractions by examining the part-whole relationship.
- This prepares children for a deep conceptual understanding of fractions.
- These small steps of learning would be explored across a week.

If Europe is the ***whole****, then the United Kingdom is* ***part of the whole****.*

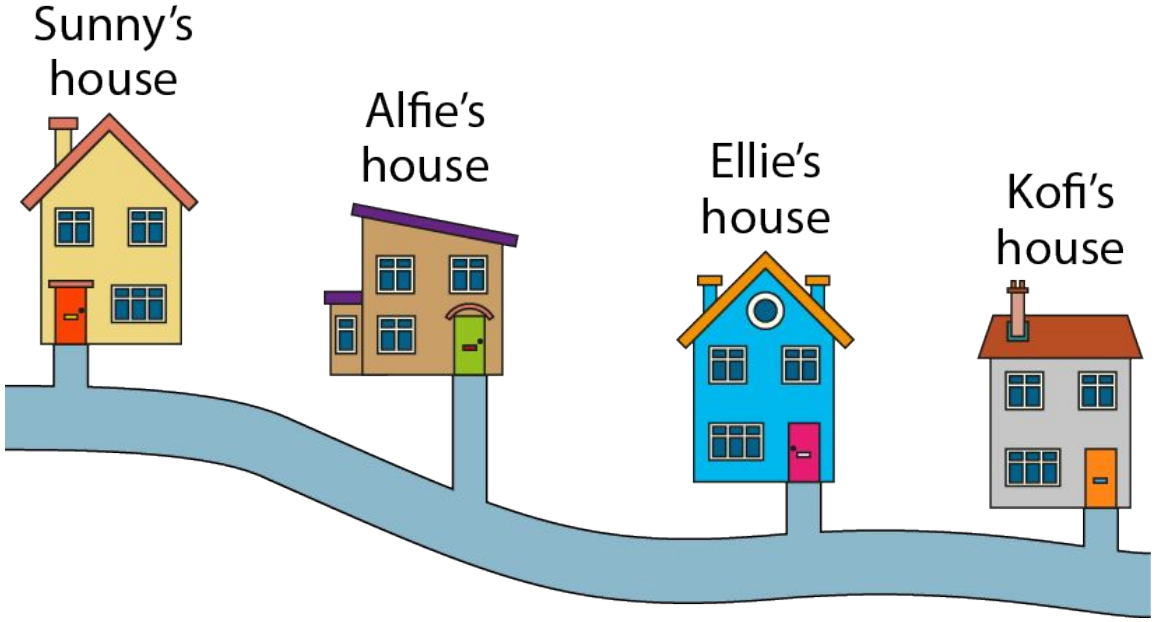
- Children will begin by looking at part-whole relationships that do not rely on any number knowledge.



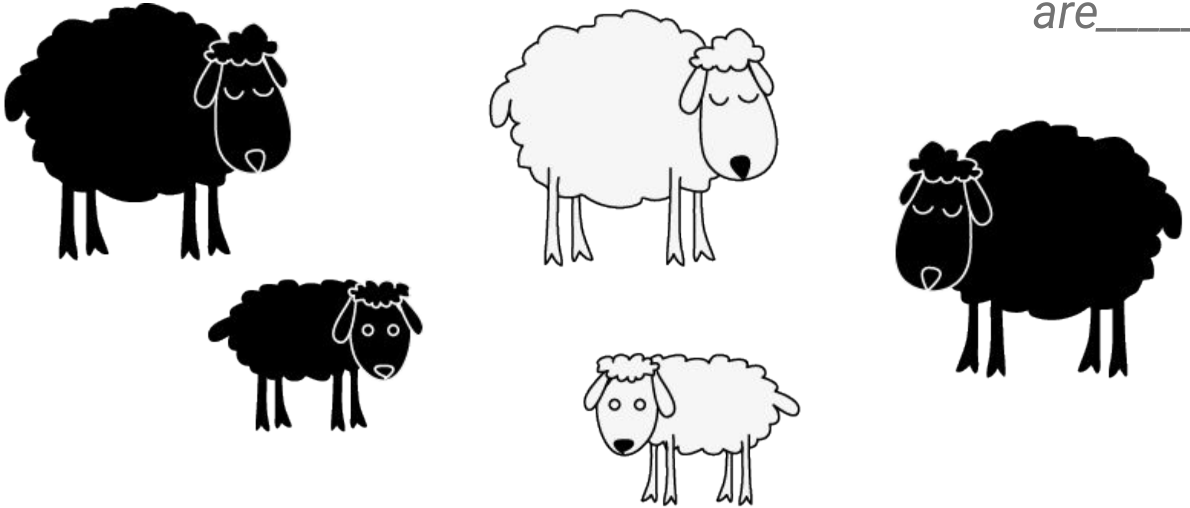
*If the United Kingdom is the **whole**, then London is ________________.*

- Children will begin by looking at part-whole relationships that do not rely on any number knowledge.
- Zooming in and redefining a part as whole, helps children understand the whole is whatever you define it as.

- The next three slides explore examples of parts and wholes they may encounter in life or word problems.



*If the journey from Sunny's house to Kofi's house is **the whole**, then the journey from Sunny's house to Alfie's house is____________________.*

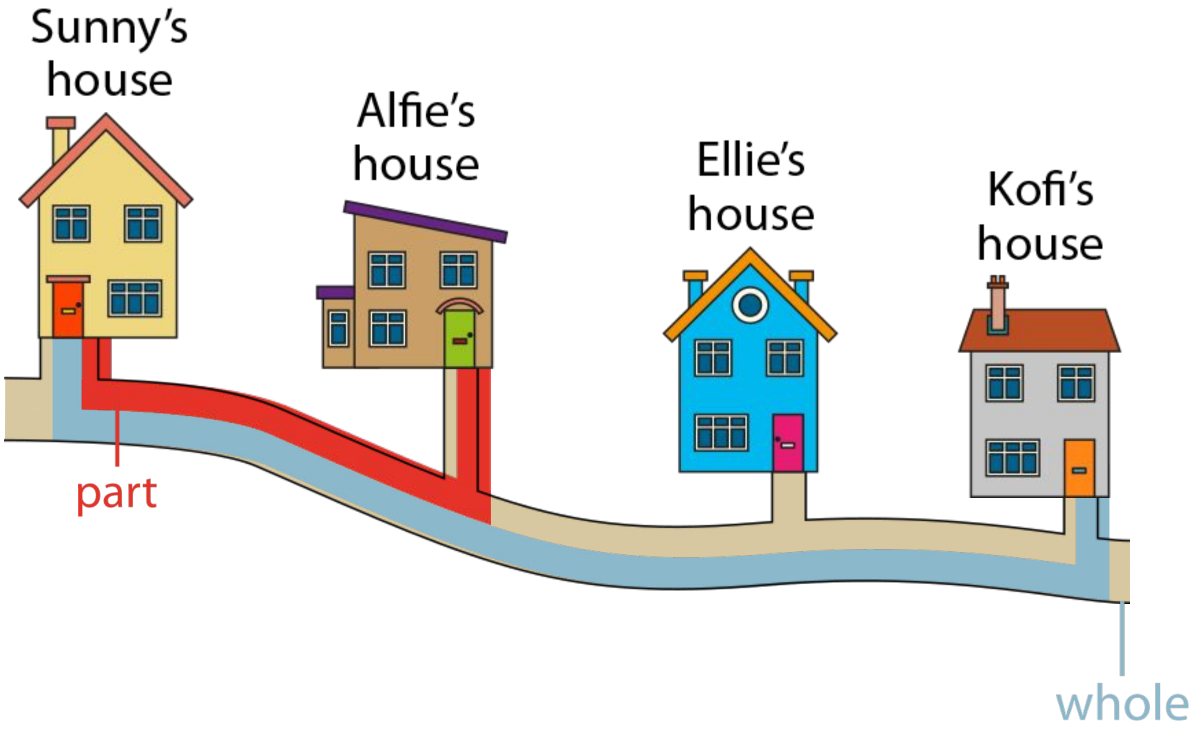


If the group of sheep is the whole, then the black sheep are___________________.

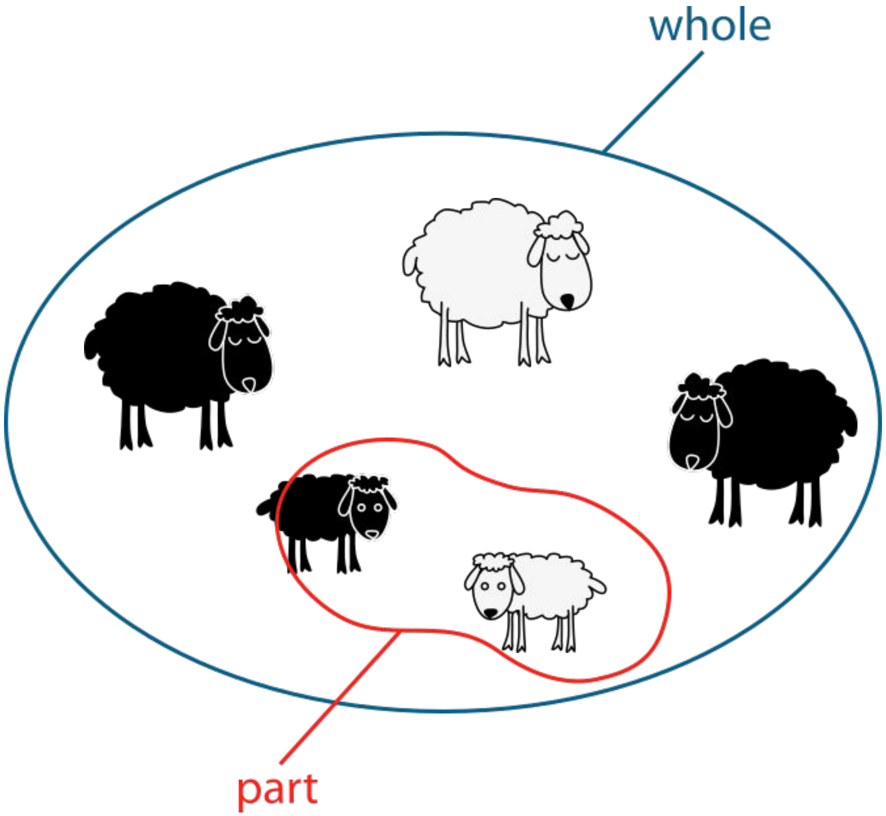
3.1 The part–whole relationship Step 1:4

Mon	Tue	Wed	Thu	Fri	Sat	Sun

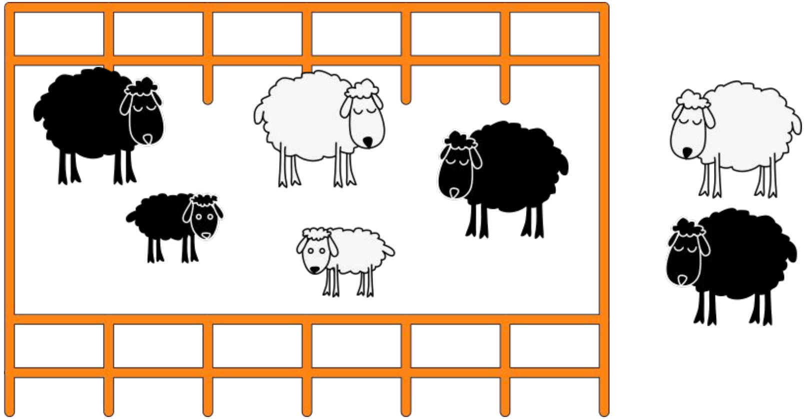
*If the week is **the whole**, then ____________ is **part of the whole**.*



- Children then start to look at the relative size of parts and wholes.
- A part is less than the whole.



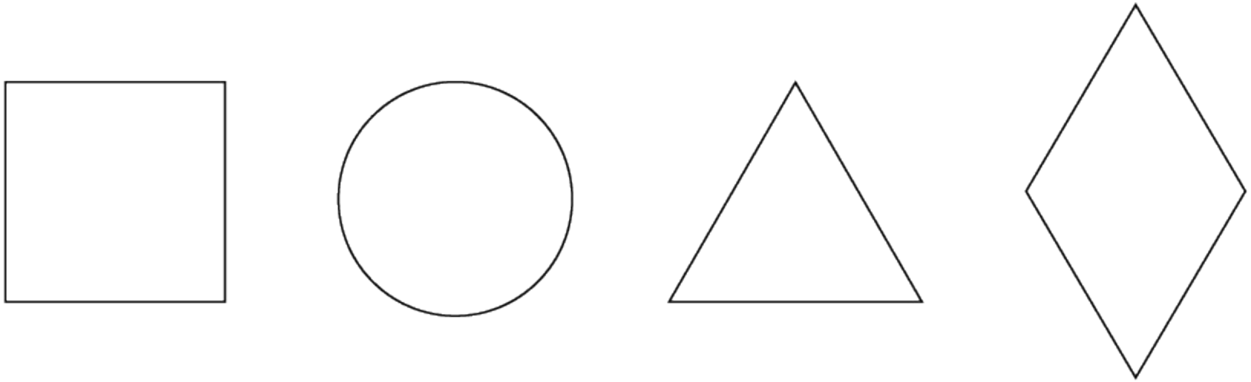
- Children then start to look at the relative size of parts and wholes.
- A part is less than the whole.
- A part is within the whole.



- There are many different ways to define the whole.

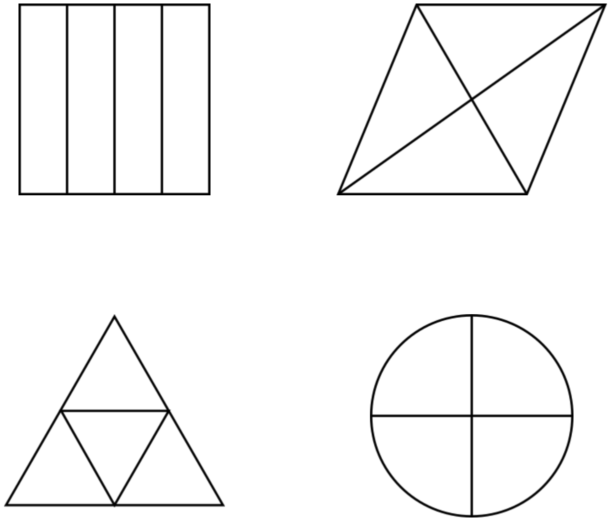
- *If all the sheep is **the whole**, then the sheep ________are **part of the whole**.*
- *If the sheep in the pen are **the whole**, then the ________in the pen are **part of the whole**.*
- *If the black sheep are **the whole**, then the __________is **part of the whole**.*

- Children will then begin to explore the part-whole relationship in shapes.

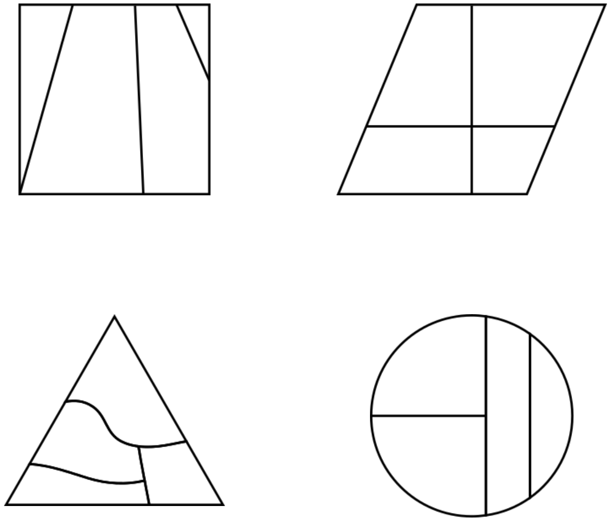


- Children will look then explore the idea of 'Equal Parts'

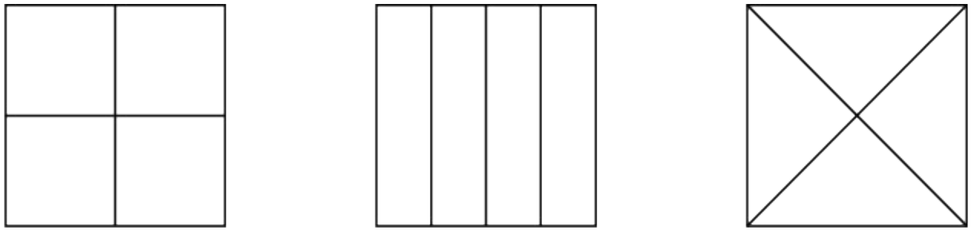
Equal parts



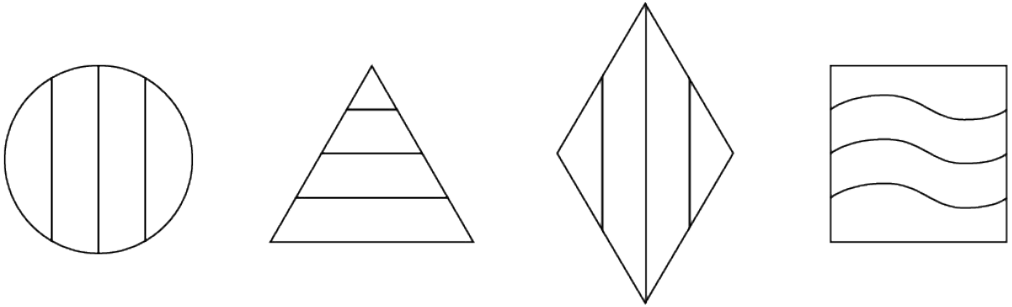
Unequal parts



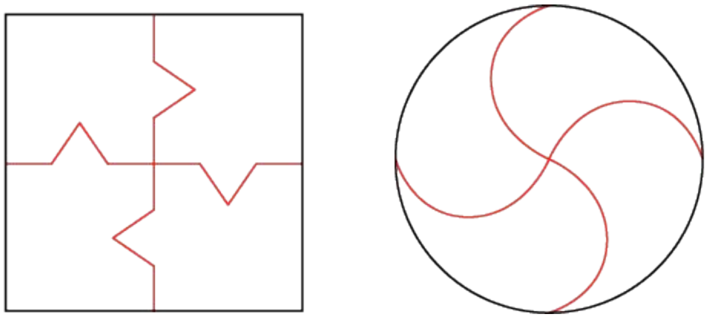
Equal or unequal parts?



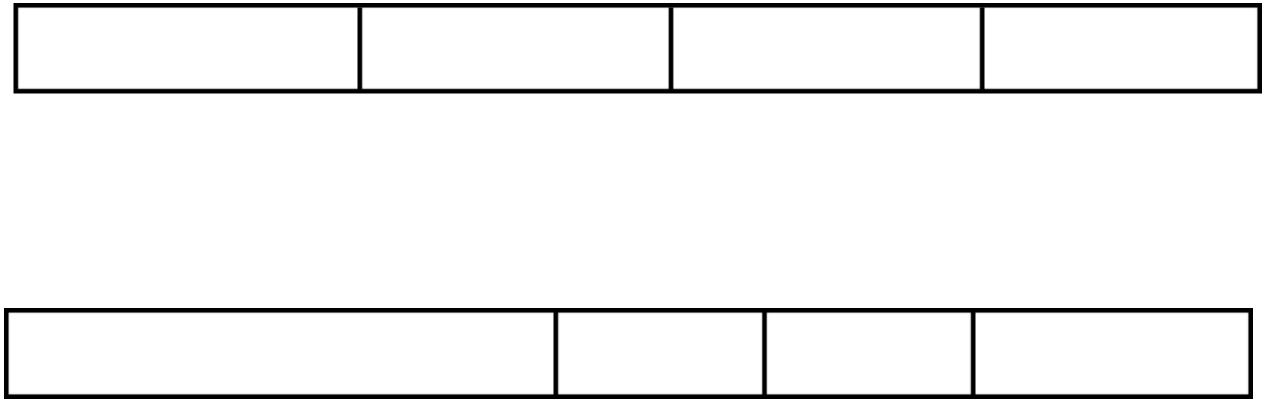
Equal or unequal parts?



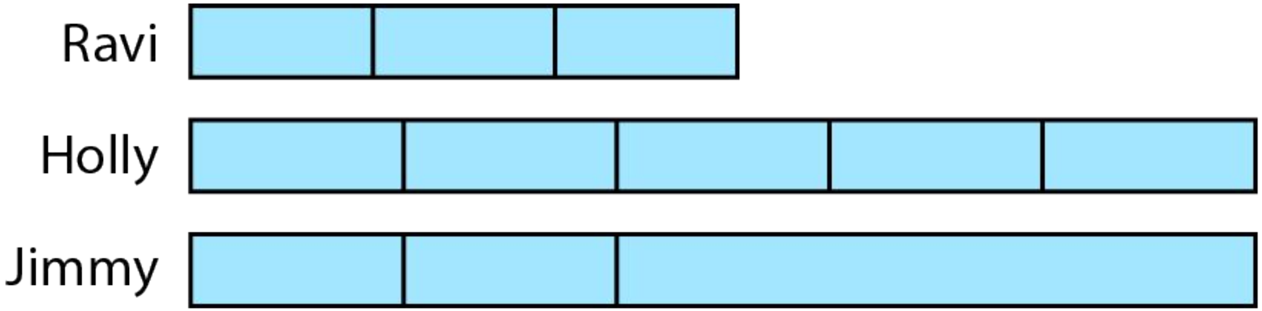
It is only possible to divide a whole into parts using straight lines.
Do you agree with this statement?



What’s the same?
What’s different?

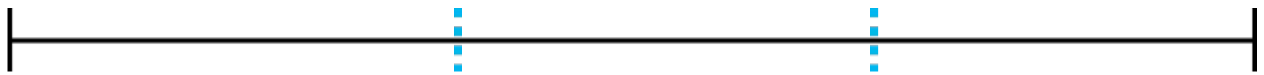


Odd one out?

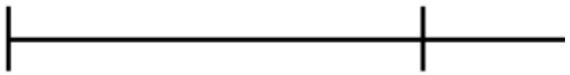


- There are lots of reasoning opportunities for children to explore.
- Can they make each of these the 'Odd One Out'?

- Children will then be asked to construct equal parts from a given whole.



- If we know one equal part, and the whole is made of three equal parts, we can work out the whole.

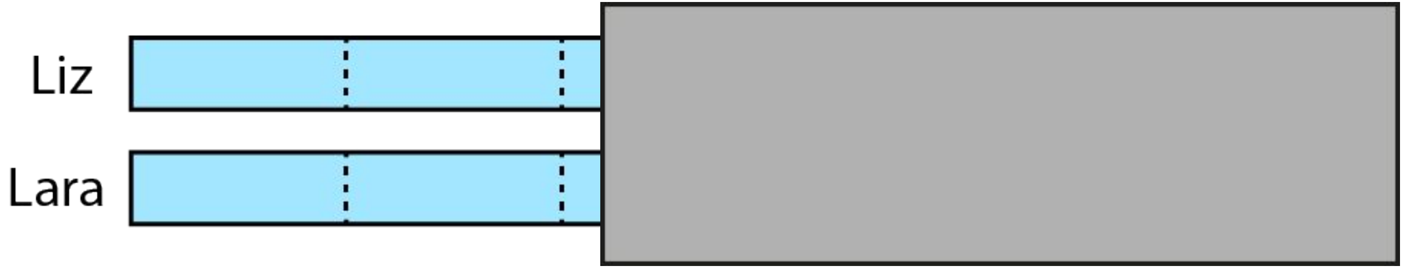


Liz has folded her paper strip into three equal parts.

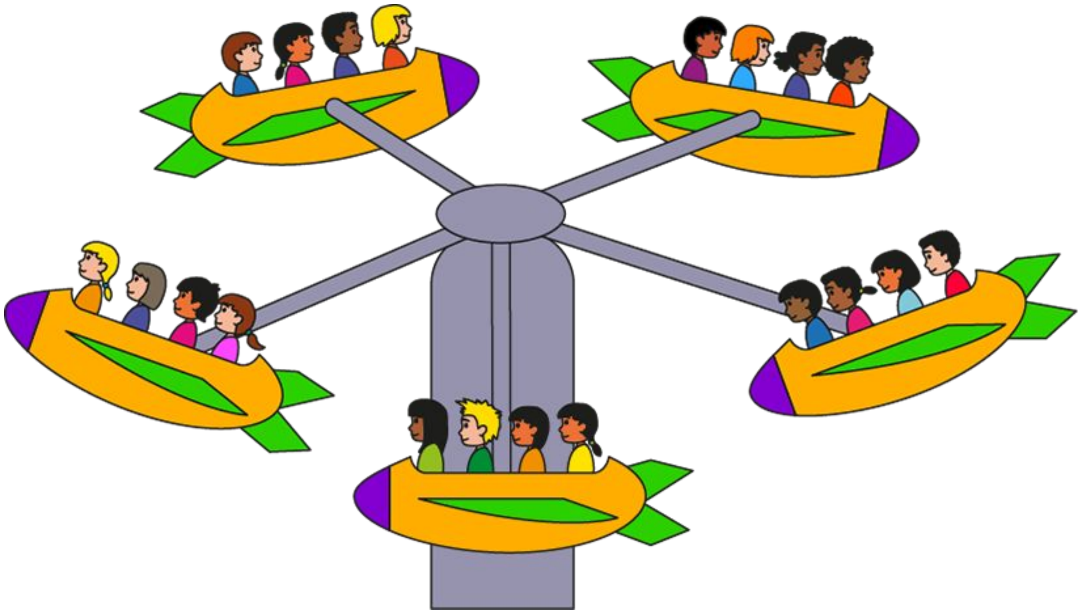
Lara has folded her paper strip into four equal parts.

Part of their strips are hidden.

Whose paper strip is longer?



The parts are *equal/unequal.* I know this because…



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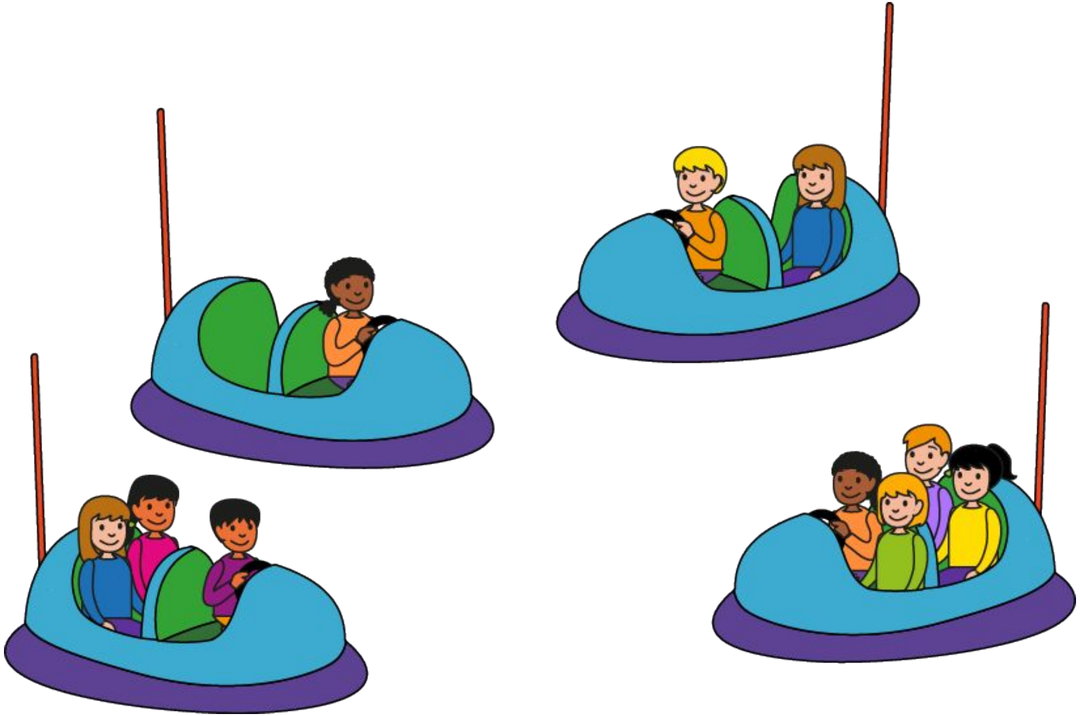
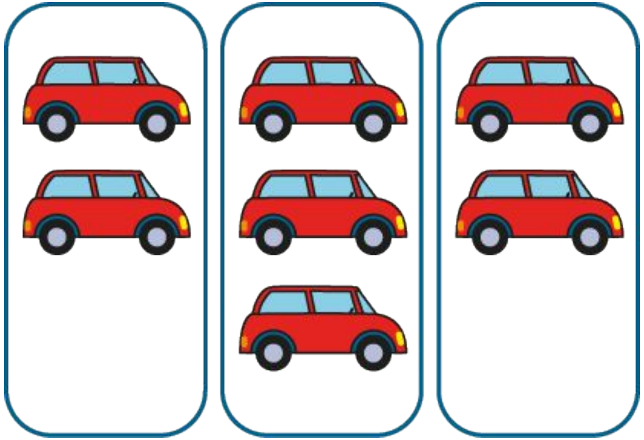
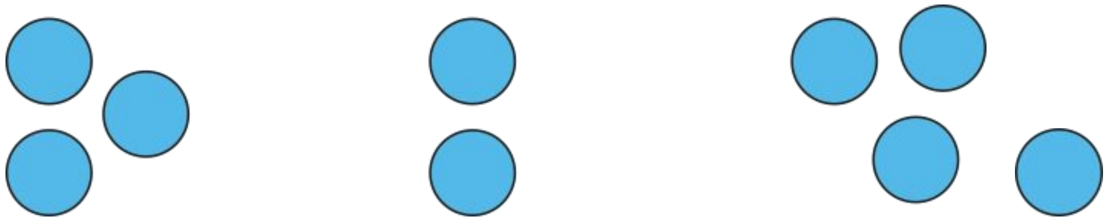


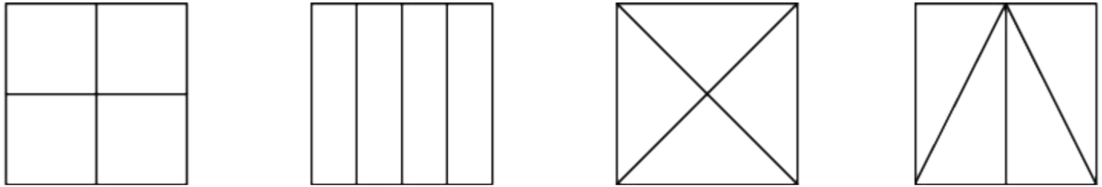
The parts are _______. I know this because…



Arrange into equal parts.

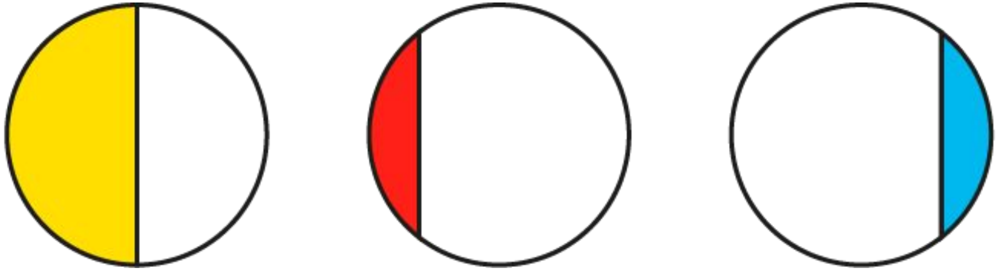


Equal or unequal parts?

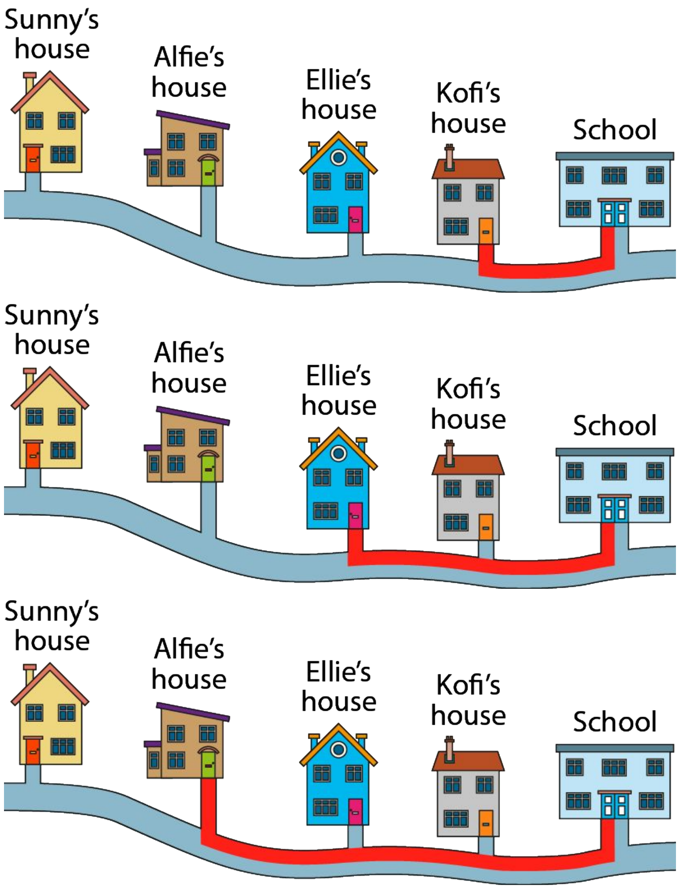


- Children will then begin to compare the size of the parts.
- The yellow part is larger than the red part.

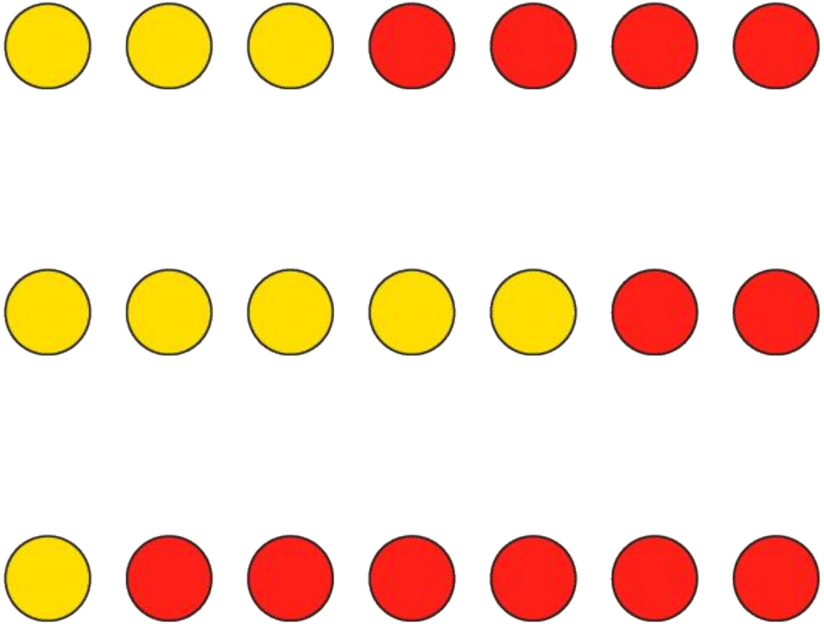
What is the same? What is different?



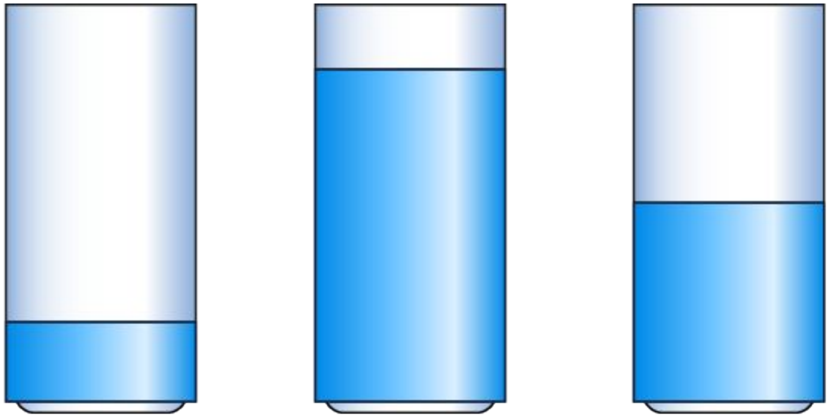
Poland is a bigger part of Europe than Portugal is.

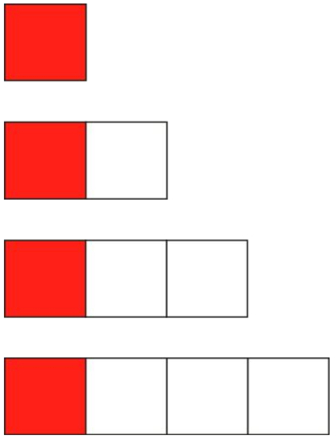


- Despite not using the language of 'quarters' yet, you can begin to see how this is laying the foundations to compare fractions.
- E.g. One quarter is larger than two quarters.



In the first set of counters, the yellow counters make up a *smaller*/ *larger* part of the whole than in the second set.





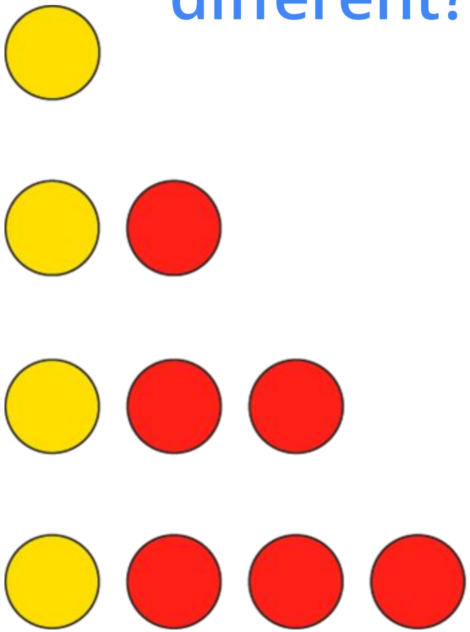
- *Basil says 'One part is shaded in each image. This means the same amount of each whole is shaded'.*

- *Jess says 'Each whole is one part larger than the previous whole. Only one part of each whole is shaded. This means that each time a smaller amount of the whole is shaded'.*

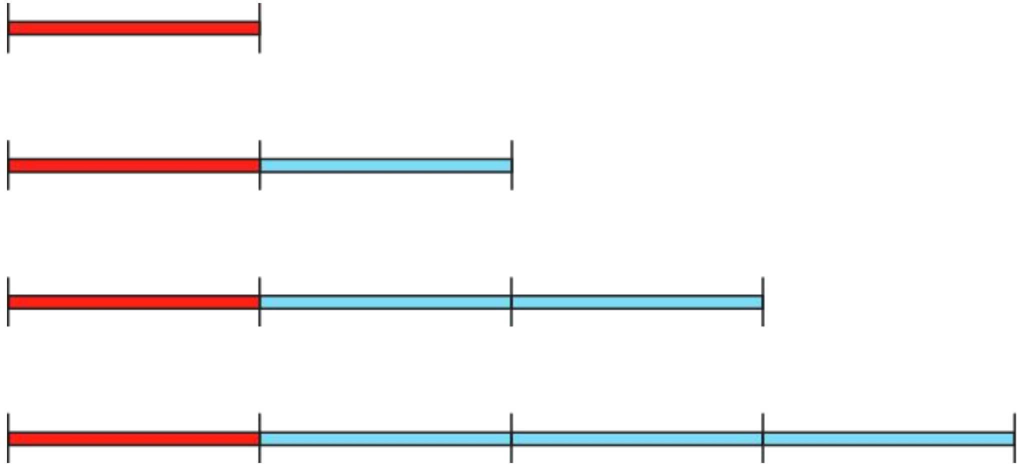
Who is correct?

- A difficult but important point, is that the whole increases in size and the size of the shaded part remains the same.
- The amount of the whole that is shaded is becoming smaller each time.

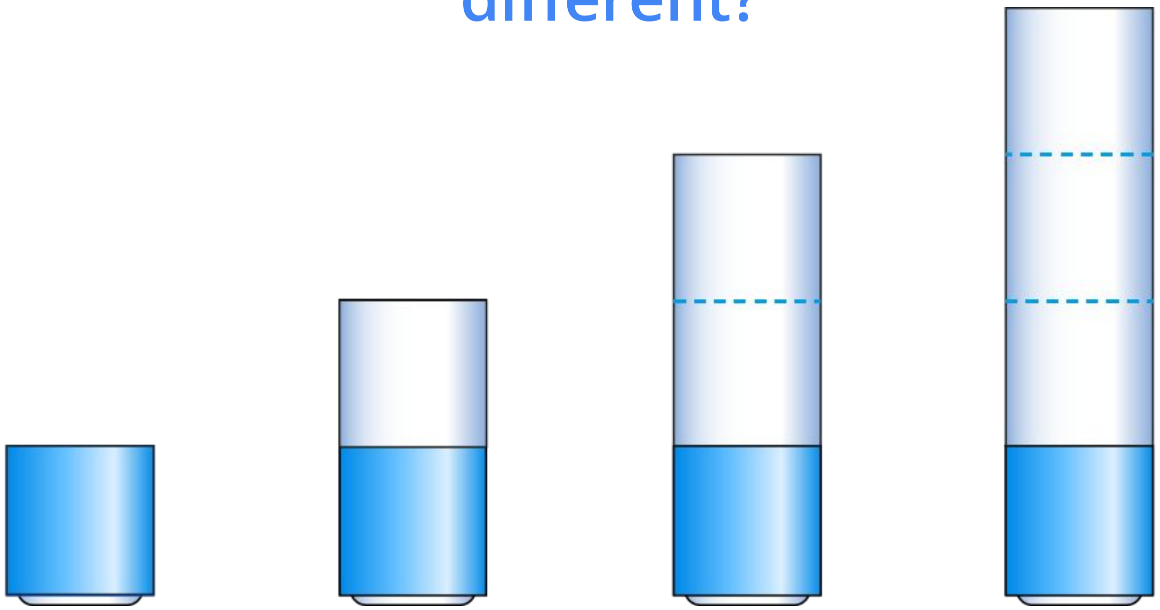
What is the same? What is different?



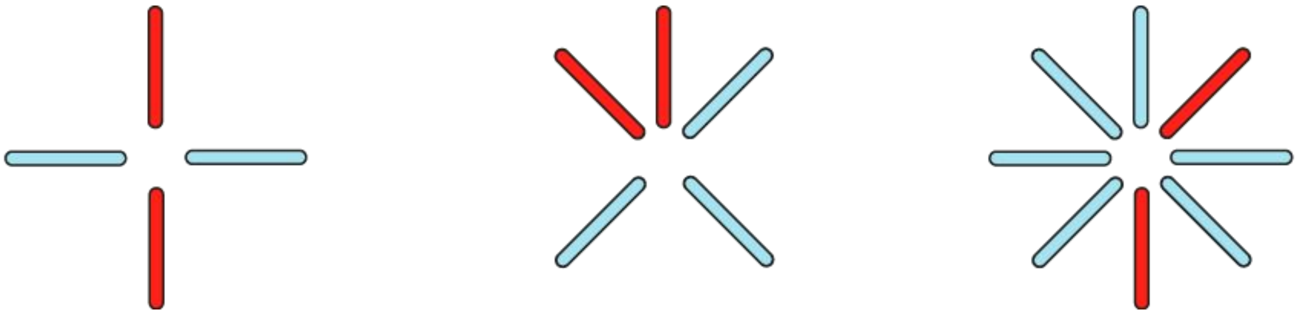
What is the same? What is different?



What is the same? What is different?

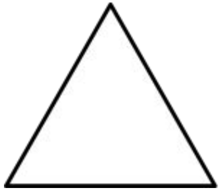


What is the same? What is different?



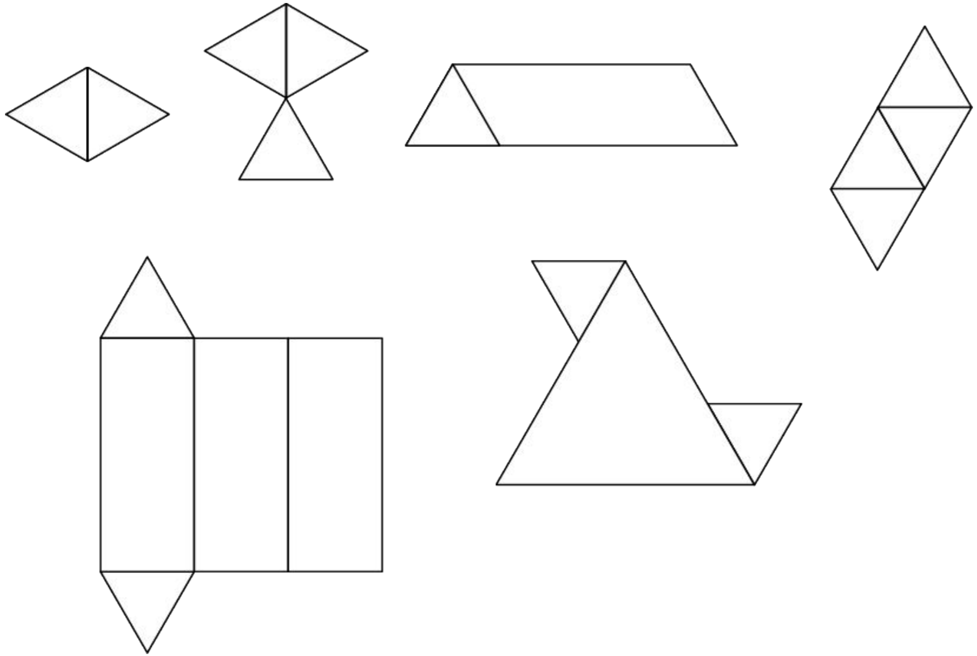
- To help children understand they can construct a whole if they know one of the equal parts and the number of equal parts, they first explore constructing a whole without the number of parts given.

What is the whole?



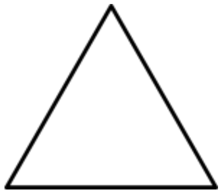
one
part

The wholes might be...



- They'll come to find there is an infinite number of possibilities.

What is the whole?

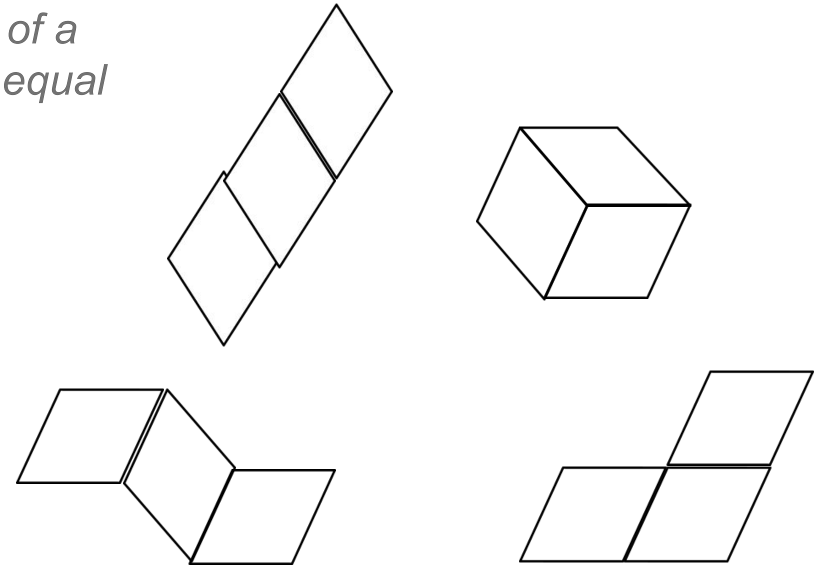


This triangle is one part of a whole made out of three equal parts.

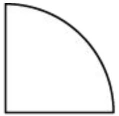
- Children are then given the number of equal parts they must use.
- This allows them to construct a whole from known parts.

What is the whole?

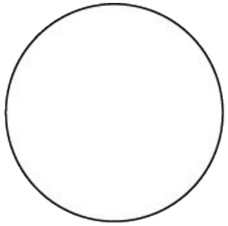
The rhombus is one part of a whole made out of three equal parts.

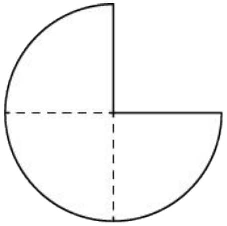


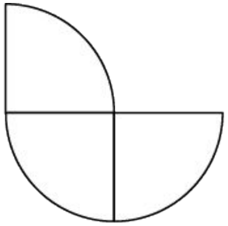
Who has drawn the correct shape? Why?

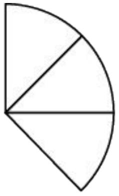


One part of
a whole made out of
three equal parts.

Max 

Beth  ✔

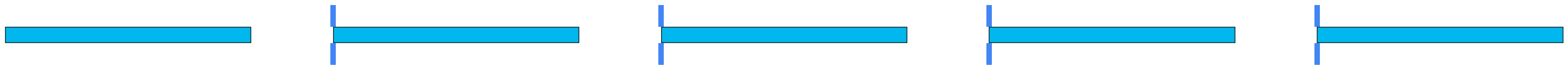
Ellen  ✔

John 

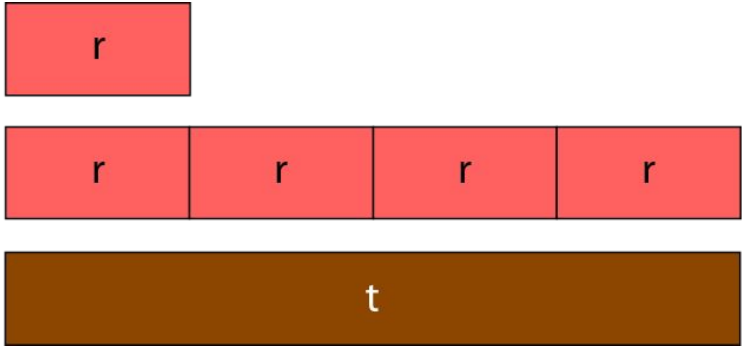
What is the whole?

one of 5 parts

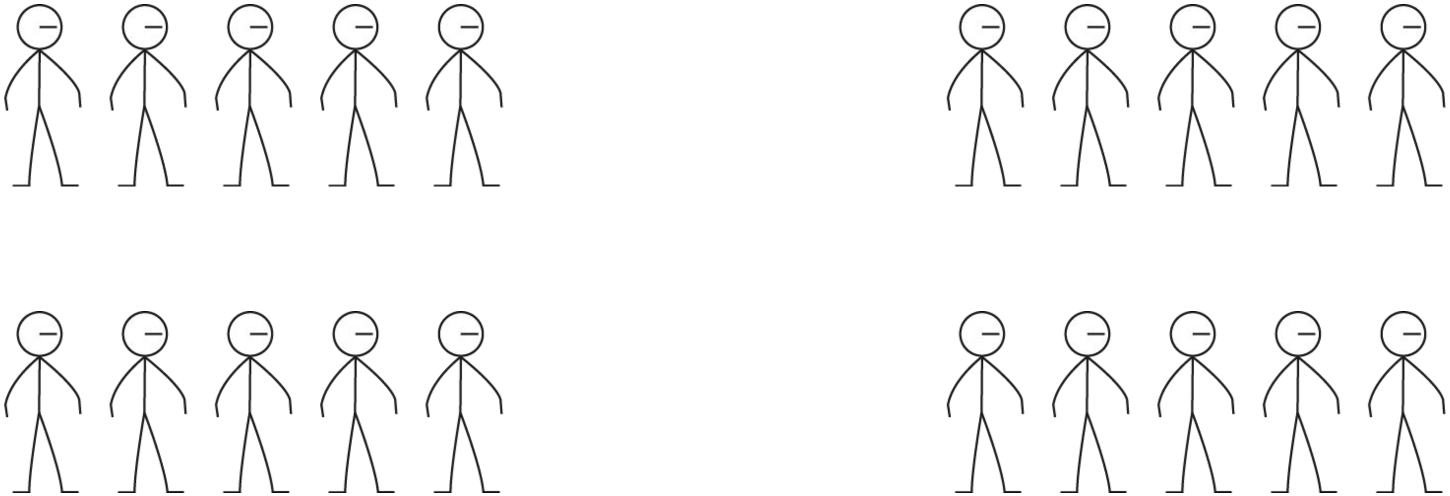
1 part of 5 parts. Draw the whole ribbon.

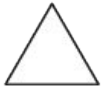
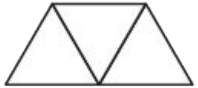
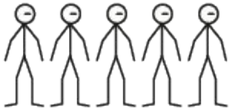
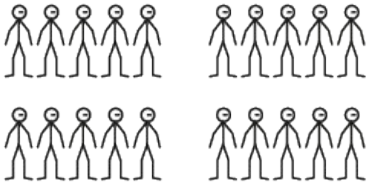


1 part of 4 parts. What is the whole rod?



1 of 4 equal teams in the class. Draw the whole class.



Part	Number of equal parts	Whole
	3	
	5	
	4	

Our mixed-age curriculum

- Our curriculum is based on the DfE guidance ‘ready to progress’
- This outlines what children need to know before they are ready to move on to the next concept.

Strand	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
			3F–1 Interpret and write proper fractions to represent 1 or several parts of a whole that is divided into equal parts.			6F–1 Recognise when fractions can be simplified, and use common factors to simplify fractions.
			3F–2 Find unit fractions of quantities using known division facts (multiplication tables fluency). →		5F–1 Find non-unit fractions of quantities.	6F–2 Express fractions in a common denomination and use this to compare fractions that are similar in value.
			3F–3 Reason about the location of any fraction within 1 in the linear number system. →	4F–1 Reason about the location of mixed numbers in the linear number system.		6F–3 Compare fractions with different denominators, including fractions greater than 1, using reasoning, and choose between reasoning and common denomination as a comparison strategy.
				4F–2 Convert mixed numbers to improper fractions and vice versa.	5F–2 Find equivalent fractions and understand that they have the same value and the same position in the linear number system.	
			3F–4 Add and subtract fractions with the same denominator, within 1. →	4F–3 Add and subtract improper and mixed fractions with the same denominator, including bridging whole numbers.	5F–3 Recall decimal fraction equivalents for $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$ and $\frac{1}{10}$, and for multiples of these proper fractions.	

Department for Education

National Centre for Excellence in the Teaching of Mathematics

Mathematics guidance: key stages 1 and 2

Non-statutory guidance for the national curriculum in England

June 2020

Our mixed-age curriculum

Y3/4 A	1	2	3	4	5	6	7	8	9	10	11	12	13
C1	Unit 1 (NCETM Y3) Adding and subtracting across 10 ⚓		Unit 2 (NCETM Y3) Numbers to 1,000 ⚓										Consolidation
C2	Unit 3 (NCETM Y4 – Unit 2) Numbers to 10,000					Unit 4 (NCETM Y3 Unit 5 and Y4 Unit 1) Column addition Review of column addition ⚓		Unit 5 (NCETM Y3 Unit 7 and Y4 Unit 1) Column subtraction Review of column subtraction ⚓	Unit 6 (NCETM Y4 Unit 4) 3, 6, 9 times tables				Consolidation
C3	Unit 7 (NCETM Y4 Unit 4) 7 times table and patterns		Unit 8 (NCETM Y4 Unit 8) Review of fractions from KS1	Unit 9 (NCETM Y3 Unit 8) Unit fractions ⚓	Unit 10 (NCETM Y3 Unit 9) Non-unit fractions ⚓	Unit 11 (NCETM Y4 Unit 9) Fractions greater than 1 ⚓				Unit 12 (NCETM Y3 Unit 10) Parallel and perpendicular sides in polygons		Unit 13 (NCETM Y4 Unit 10) Symmetry in 2D shapes	Consolidation

Y3/4 B	1	2	3	4	5	6	7	8	9	10	11	12	13
C1	Unit 1 (NCETM Y3) Adding and subtracting across 10 ⚓		Unit 2 (NCETM Y3) Numbers to 1,000 ⚓		Unit 3 (NCETM Y3 Unit 4) Manipulating the additive relationship and securing mental calculation				Unit 4 (NCETM Y3 Unit 5 and Y4 Unit 1) Column addition Review of column addition ⚓		Unit 5 (NCETM Y3 Unit 7 and Y4 Unit 1) Column subtraction ⚓ Review of column subtraction	Unit 6 (NCETM Year 3 Unit 6) 2, 4 and 8 times tables	
C2	Unit 6 (NCETM Year 3 Unit 6) 2, 4 and 8 times tables	Unit 7 (NCETM Y4 – Unit 6) Understanding and manipulating multiplicative relationships					Unit 8 (NCETM Y3 Unit 8) ⚓ Unit fractions					Unit 9 (NCETM Y3 Unit 9) ⚓ Non-unit fractions	
C3	Unit 9 (NCETM Y3 Unit 9) ⚓ Non-unit fractions		Unit 10 (NCETM Y4 Unit 9) Intro to fractions greater than 1 ⚓		Unit 11 (NCETM Y3 Unit 3) Right Angles		Unit 12 (NCETM Y4 Unit 3) Perimeter		Unit 13 (NCETM Y4 Unit 7) Coordinates		Unit 14 (NCETM Y3 Unit 11) Time	Unit 15 (NCETM Y4 Unit 12) Division with remainders	

Anchor Units

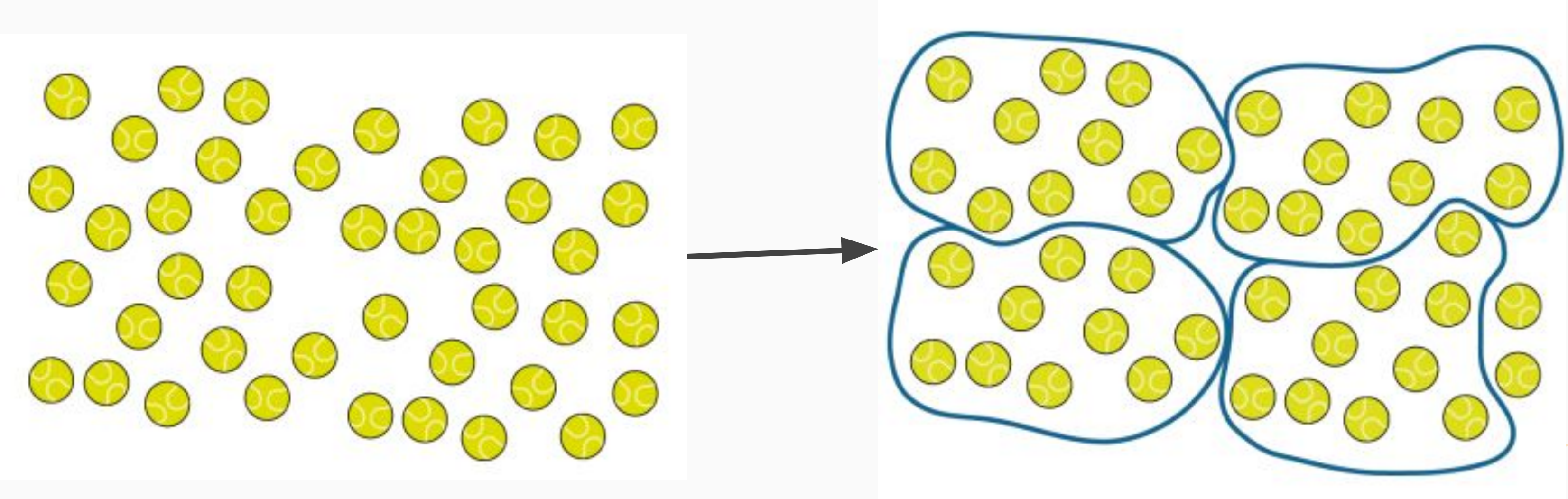
Where children need to have foundational knowledge to progress, the content is explored in both Year A and B. We call these 'anchor units'.

Design links to prior learning to ensure all can access the new learning and identifies carefully sequenced steps in progression to build secure understanding.

Exploring a concept at depth

Teaching point 2:

Objects can be counted efficiently by making groups of ten. The digits in the numbers 20–99 tell us about their value.



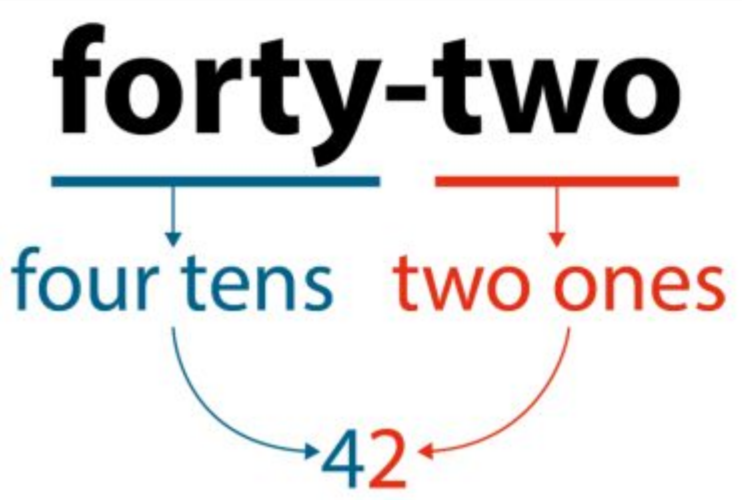
Exploring a concept at depth

Groups of ten	Extra ones
4	2

- *'The 4 shows we have four groups of ten.'*
- *'The 2 shows we have two extra ones.'*
- *'We have four groups of ten and two more ones.'*

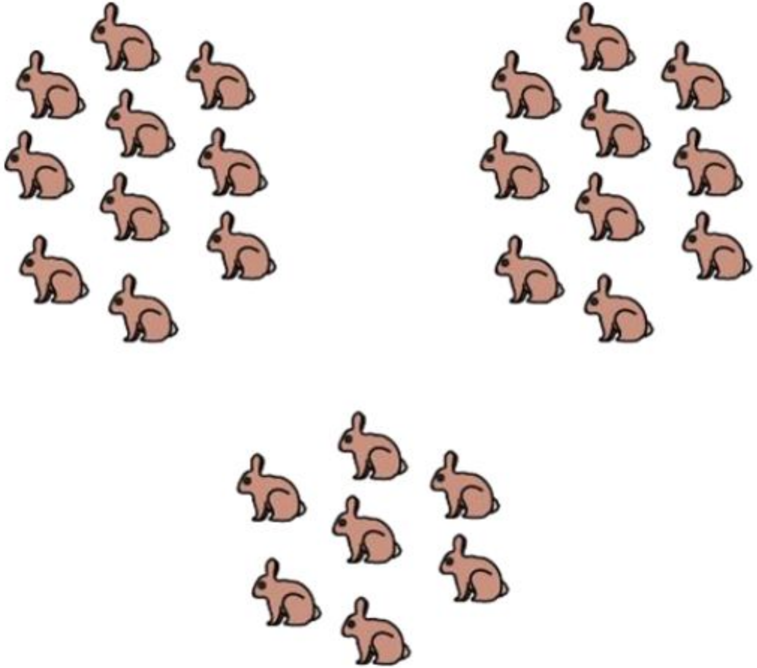
10s	1s
4	2

42



Exploring a concept at depth

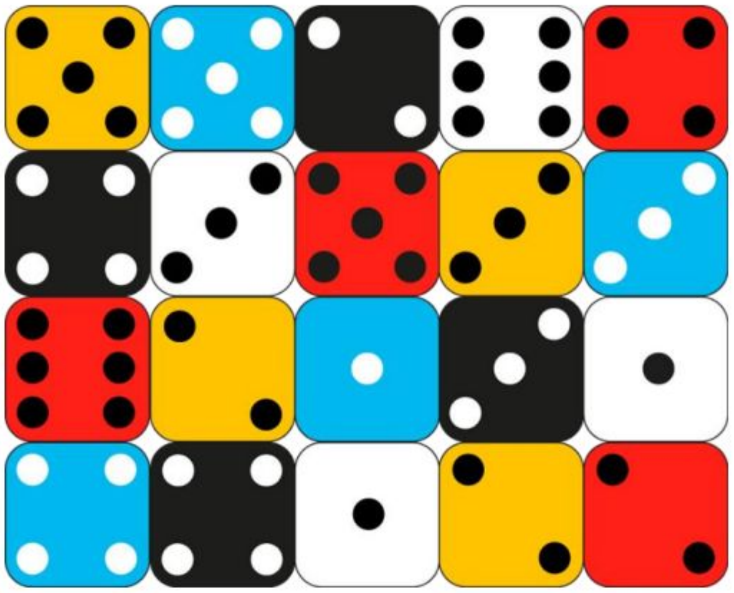
'How many rabbits are there?'



10s	1s

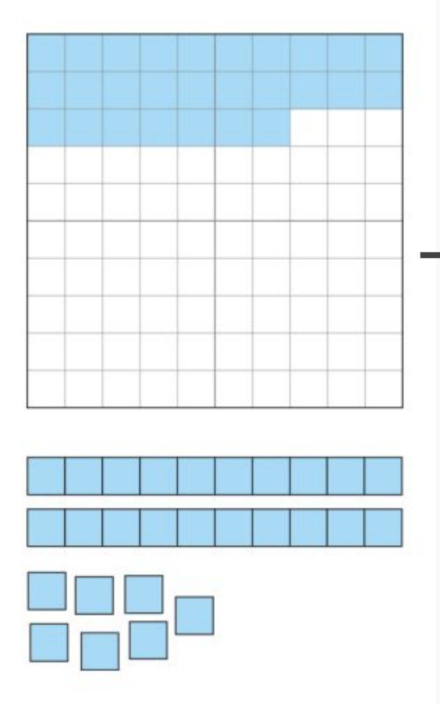
Exploring a concept at depth

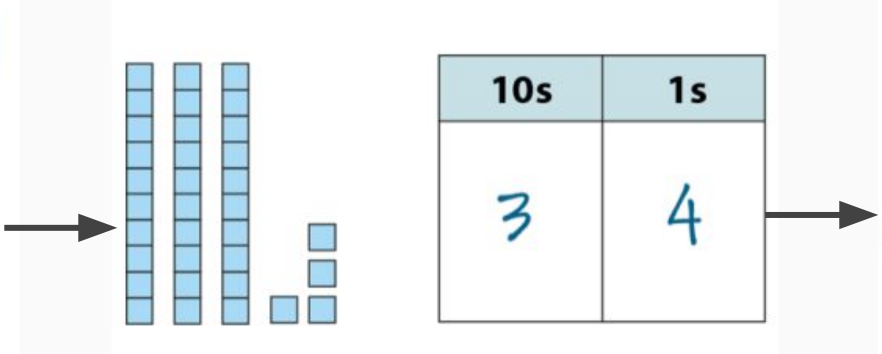
'How many dots are there altogether?'
'How could you count these efficiently?'

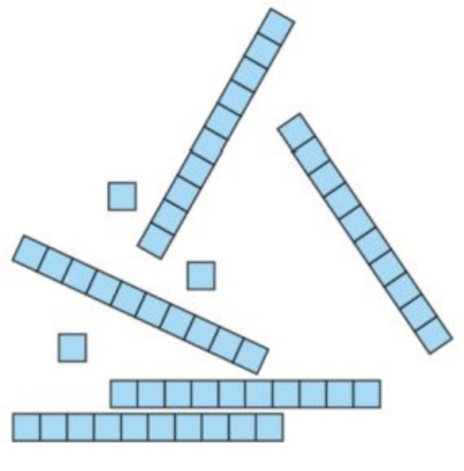


- Children who are very secure in this concept, will be able to apply their understanding of making groups of ten to complete this challenge.

Exploring a concept at depth

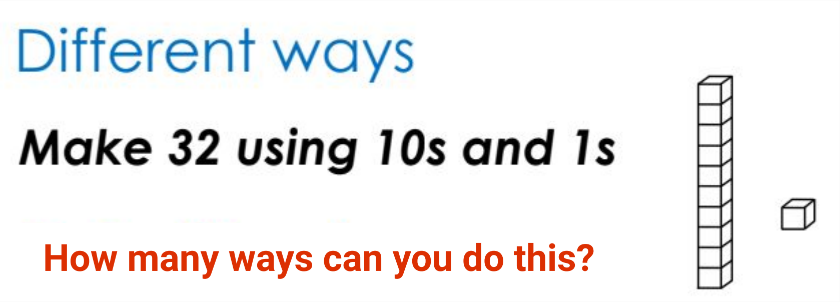


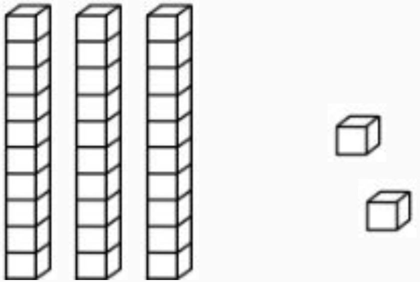




- Children will begin to explore this concept with the use of dienes.

Exploring a concept at depth





- Children who are very secure in their understanding of the value of ten and one, will be able to manipulate the groups of ten to create compositions of 32 that look like:
  30 + 2
  20 + 12
  10 + 22
  32

Exploring a concept at depth

Teaching point 4:

Numbers with tenths can be composed additively and multiplicatively.

$$1 + \square \times 0.1 = 10 \times 0.1 + 0.8$$

- When children are very secure in the understanding of tenths and ones, they will be able to balance this equation.

Exploring a concept at depth

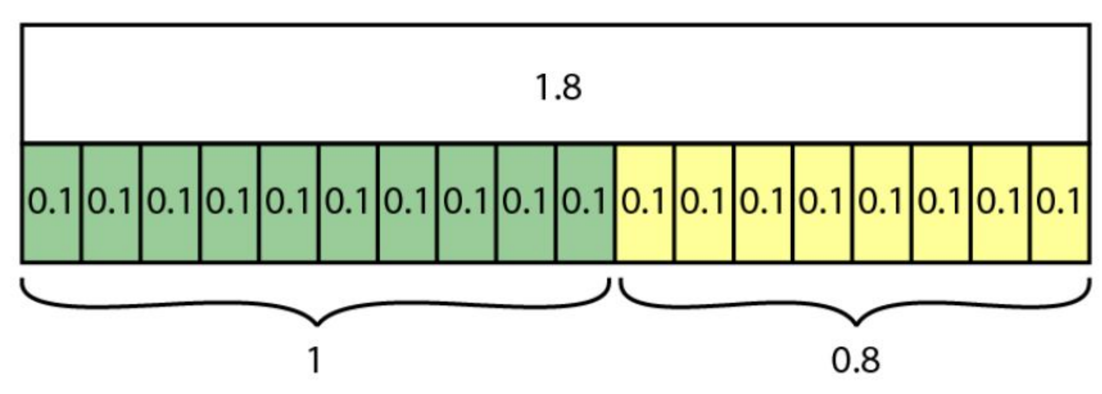
0.5 = 0.1 + 0.1 + 0.1 + 0.1 + 0.1

↓

0.5 = 5 x 0.1

- The concept begins by looking at how 0.5 can be composed.

Exploring a concept at depth



10 x 0.1 = 1

8 x 0.1 = 0.8

1 + 0.8 = 1.8

1 + 8 x 0.1 = 1.8

10 x 0.1 + 0.8 = 1.8

1 + 8 x 0.1 = 10 x 0.1 + 0.8

- Children can then be extended to composition of numbers with tenths that are greater than one.
- Children who are secure in their understanding of 10 x 0.1 = 10 and 0.1 x 8 = 0.8 can explore writing this in different ways.

Importance of fluency

Over-reliance on counting restrains flexible thinking

- Many children leave KS1 without fluency in number facts within ten and instead rely on counting in ones or on fingers to add and subtract. This is associated with low attainment in maths (Tall and Gray 1994).
- Gray (2009) points out, that over-reliance on lengthy counting procedures limits children's attention to numerical relationships, regularities and concepts and therefore restrains flexible thinking and the development of concept-based problem solving strategies.

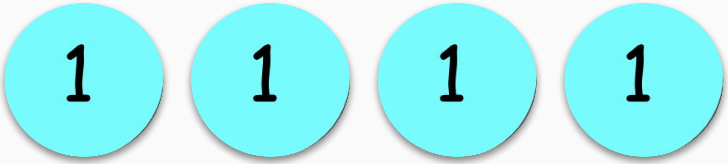
Don't Count

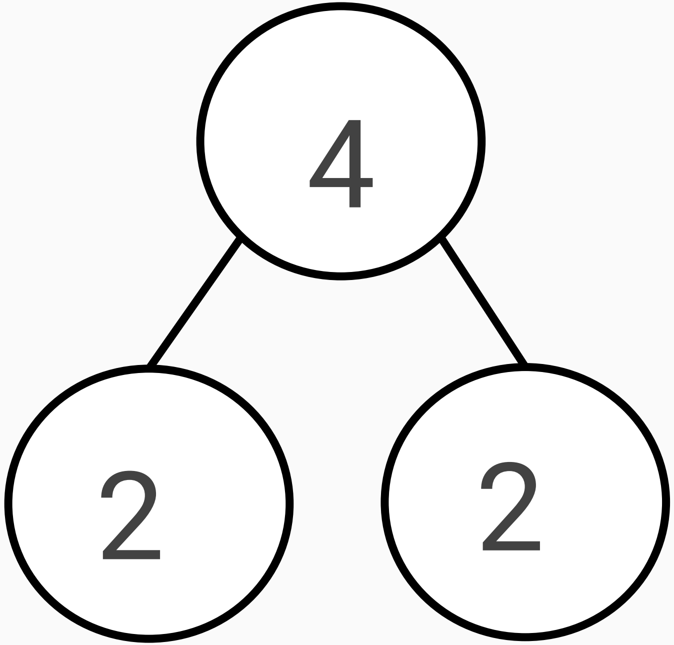
Whilst some progress to use their knowledge in a flexible and powerful way, **others seek security in counting procedures** which work promisingly in simple tasks but fail to generalise when greater sophistication is required.

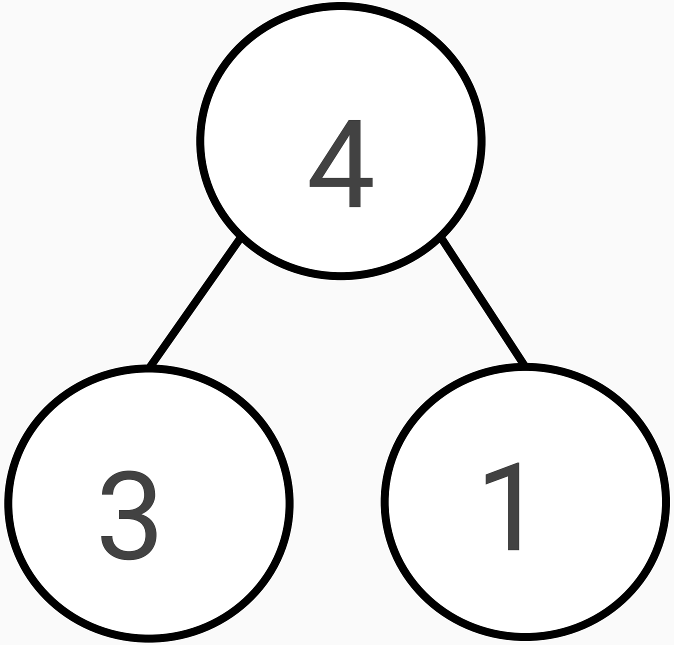
Those who fail are doing a more difficult kind of mathematics compared to those who succeed.

Importance of Fluency

- In EYFS, children will explore the composition of the number.
- This is essential to their future success in maths.
- Let’s take 4 as an example.







Importance of Fluency

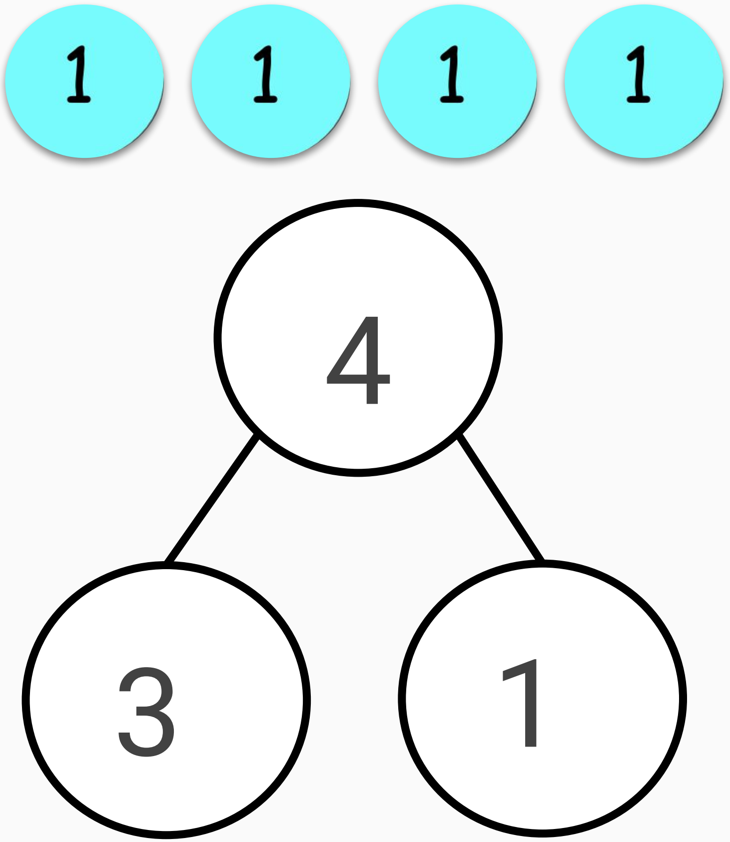
Understanding the composition of four, is the early stages of understanding additive structures.

$4 = 3 + 1$

$4 = 1 + 3$

$4 - 3 = 1$

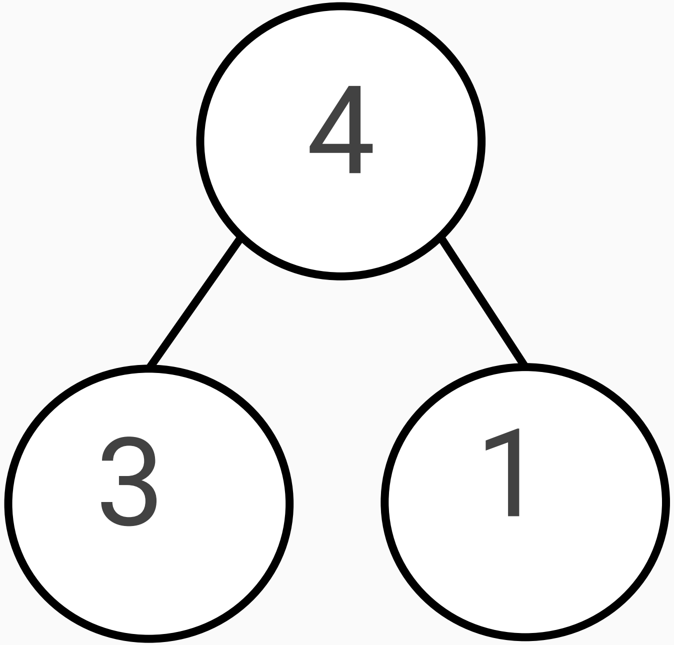
$4 - 1 = 3$



Importance of Fluency

- Knowing 3 + 1 = 4 instantly will allow children to access larger numbers.
- It frees up their working memory, and allows them to tackle more complex problems.

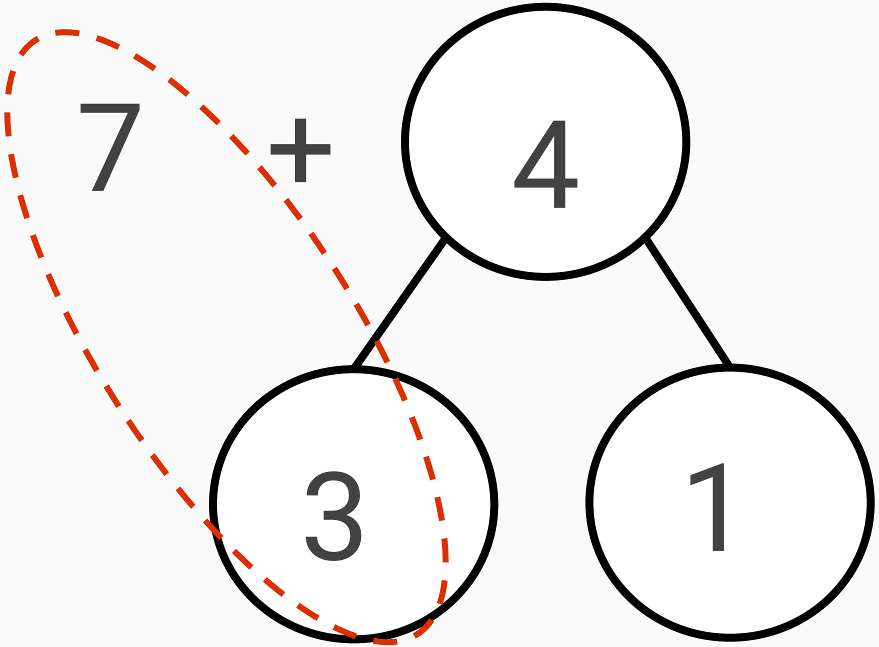
40,000 = 30,000 + 10,000
40,000 = 10,000 + 30,000
40,000 - 30,000 = 10,000
40,000 - 10,000 = 30,000



Importance of Fluency

7 + 4 =

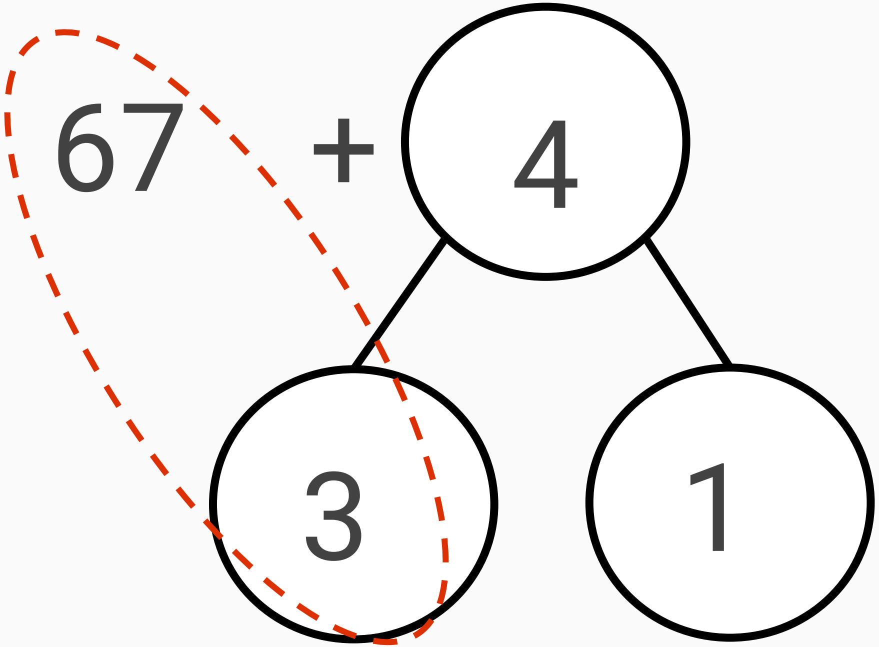
- Knowing 3 + 1 = 4 instantly will allow children to bridge 10



Importance of Fluency

67 + 4 =

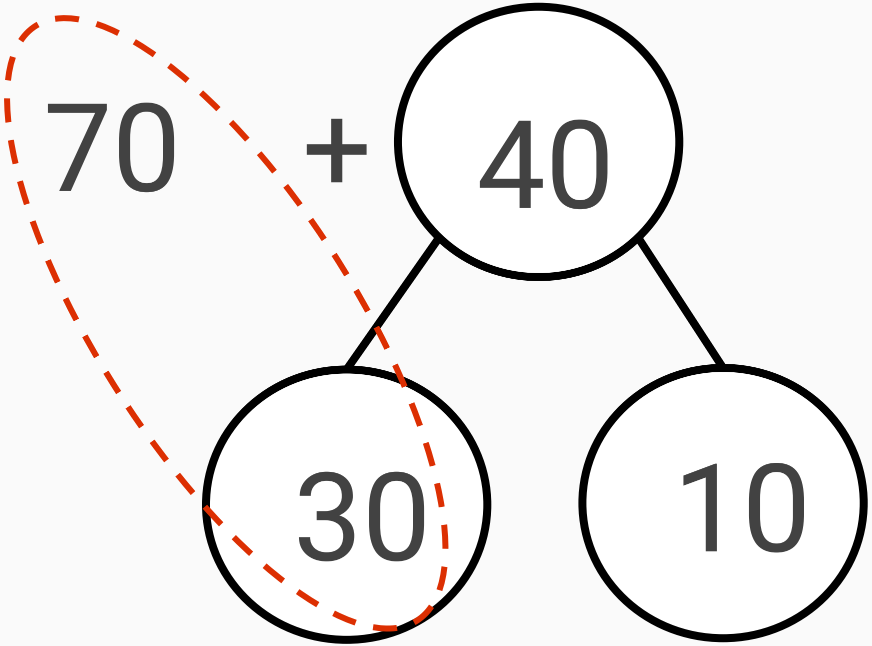
- Knowing 3 + 1 = 4 instantly will allow children to bridge multiples of 10



Importance of Fluency

70 + 40 =

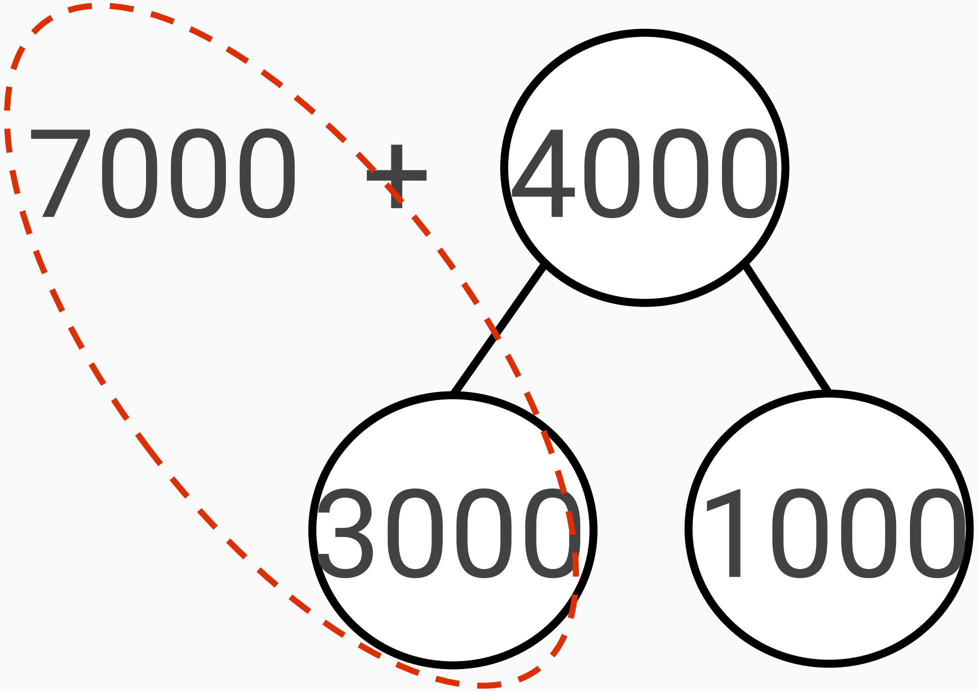
- Knowing 3 + 1 = 4 instantly will allow children to bridge multiples of 10, including 100



Importance of Fluency

7000 + 4000 =

- Knowing 3 + 1 = 4 instantly will allow children to bridge 10,000



Importance of Fluency

575 + 342 =

- Knowing 3 + 1 = 4 instantly will allow children to do 7 + 4 more efficiently, freeing up their working memory to calculate this with automaticity.

```
 575
+342
____

____
```

Importance of Fluency

If I know... 6 x 7 = 42

I also know...

7 x 6 = 42

42 ÷ 6 = 7

42 ÷ 7 = 6

6 x 70 = 420

60 x 70 = 4,200

6 x 700 = 4,200

...

Importance of Fluency

- Automatic recall of 6 x 7 = 42, allows children to access this questions efficiently.
- They do not need to rely on counting procedures
- This reduces the cognitive load.

Find

$$\frac{2}{7} \text{ of } 42$$

$$6 \times 7 = 42$$

Convert into a mixed number

$$\frac{47}{7}$$

$$\frac{3}{7} + \frac{5}{6}$$

$$326 \times 27 =$$

Feedback form

Please let me know how you found today's session and what you would like your future workshops to look like.

https://forms.gle/3hKQ49HBNgwWRZYU6